Acquisition of a Large Stage Atomic Force Microscope for Undergraduate Teaching and Research

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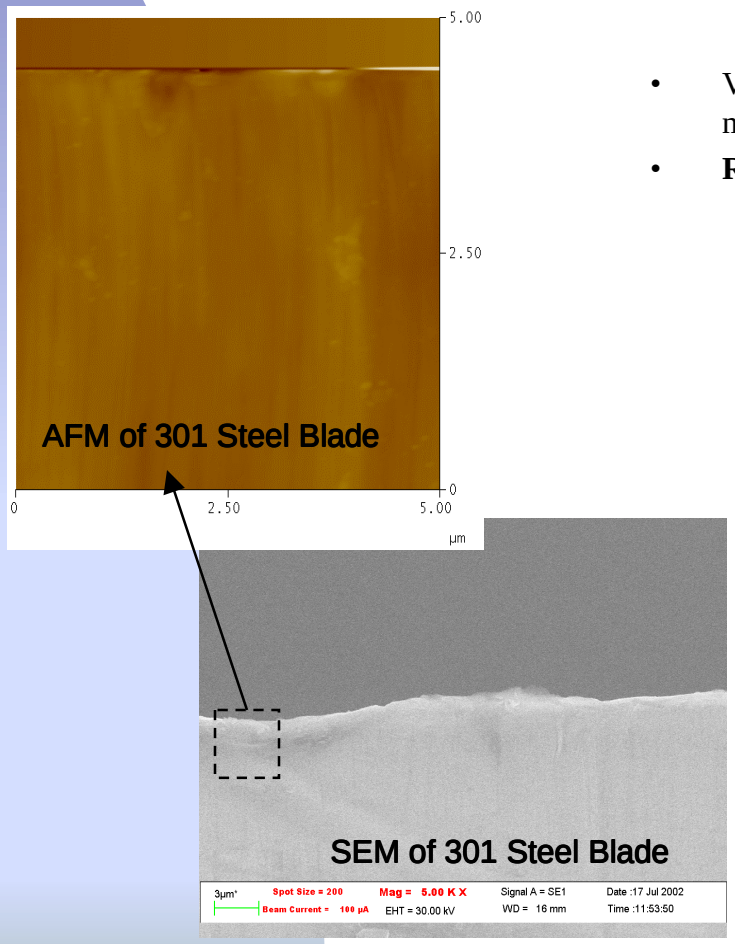
RECENT ACTIVITIES



Example data of stainless steel blade characterized with AFM and SEM

- Veeco Metrology Dimension 3100 Large-stage scanning tunneling / atomic force microscope (STM / AFM) was purchased and installed in November 2001.
- **Research Projects Utilizing AFM to Date:**
  - Characterization of the microfabrication and hot-embossing of PMMA sheet for microfluidic devices. AFM has been used to characterize coating technologies using nanocomposite polymer-POSS (polyhedral oligiomeric silsequioxane) thin films to aid in surface passivation and substrate bonding.
  - Microfabrication and characterization of microcontact printing masters using Si / SiO_2 technology. Lateral force microscopy (LFM) used to measure the effect of molecular self-assembly of alkanethiols on gold surfaces. This will be used to direct the deposition of biological molecules such as the biodegradable polymer polyhydroxybutyrate (PHB) and the DNA repair protein, RecA.
  - Characterization of complex oxide thin films of barium strontium titanate (BST) produced by sol-gel synthesis and chemical solution deposition. AFM used to determine defect density of surfaces.
  - Collaboration with area small business initiated to characterize the surface microstructure of stainless steel blades used for industrial and medical applications. AFM and SEM has been used to characterize the edge roughness and the sharpness of the blade and to correlate manufacturing processes with edge quality.
  - Area high school students (from the Governor's School in Staunton, VA) have used AFM to characterize thin films of organic light emitting polymers and to evaluate the cleaning rate of an aluminum cleaner used by an area small business.

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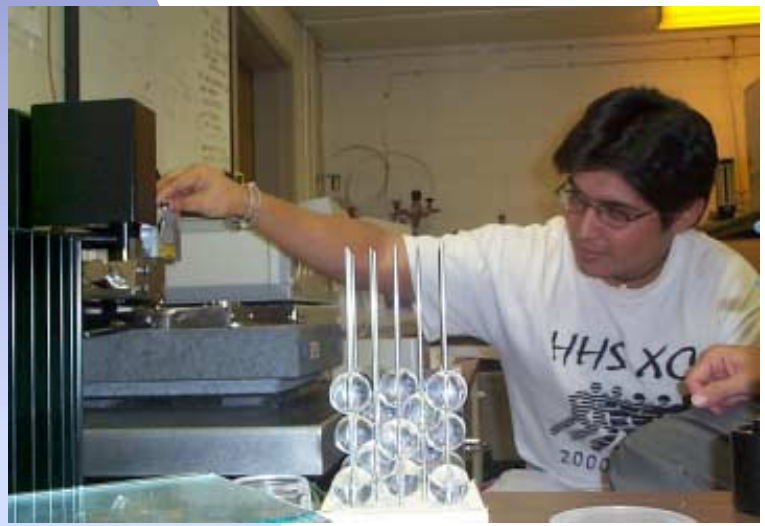
UNDERGRADUATE MENTORING AND INDUSTRIAL COLLABORATION



[JMU sophomore, Renzo Olguin, is preparing the large-stage AFM to measure the surface of a silicon wafer that has been patterned using photolithography to be used for microcontact printing.]

The NSF-IMR program funded the purchase of a state-of-the-art large-stage scanning tunneling / atomic force microscope (STM / AFM) which has been used by **undergraduates** and **high school students** to study microfabricated devices such as **microfluidics**, **biodegradable polymers**, and **patterned** and **biologically functionalized surfaces**. This instrument was used by students funded through NSF-sponsored REU (Research Experiences for Undergraduates) sites in chemistry and materials science at JMU. Students involved in these activities are introduced to research during a 10 week program during the summer, and many decide to attend graduate school in science and engineering as a result of the experience gained during these programs.

This NSF-IMR program has also been used to initiate a **collaboration** with an area **small business** and help solve a manufacturing problem that would otherwise be difficult to solve. Through a grant with Virginia's Center for Innovative Technology, we have been working with Specialty Blades, Inc. of Staunton, VA to study the microstructure of stainless steel blades using the AFM and SEM instruments purchased through the NSF-IMR program.

Virginia's Center for Innovative Technology